

What is claimed is:

1. An electrochemical machining method comprising:

disposing a workpiece as an anode and a cathode in
5 ultrapure water in such a state that a predetermined space is
formed between said workpiece and said cathode;

disposing a catalyst having an anion exchange function
between said workpiece and said cathode; and

relatively moving said workpiece and said catalyst while
10 a voltage is applied between said workpiece and said cathode.

2. An electrochemical machining method according to
claim 1, wherein said workpiece is selected from the group
consisting of aluminum, iron, and copper.

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3. An electrochemical machining apparatus comprising:

a machining chamber for holding ultrapure water;

a cathode immersed in said ultrapure water held in said
machining chamber;

20 a workpiece holding portion for holding a workpiece at a
predetermined distance from said cathode so that a surface, to
be machined, of said workpiece is brought into contact with
said ultrapure water;

an anode contact brought into contact with said
25 workpiece held by said workpiece holding portion so that said
workpiece serves as an anode;

a catalyst having an anion exchange function, said
catalyst being disposed between said cathode and said

workpiece held by said workpiece holding portion;

a power source for applying a voltage between said cathode and said workpiece; and

a moving mechanism for relatively moving said workpiece
5 and said catalyst.

4. An electrochemical machining method comprising:

disposing a workpiece as a cathode and an anode in
ultrapure water in such a state that a predetermined space is
10 formed between said workpiece and said anode;

disposing a catalyst for dissociating water molecules
into hydrogen ions and hydroxide ions, between said workpiece
and said anode; and

applying a voltage between said workpiece and said anode.
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5. An electrochemical machining method according to
claim 4, wherein said workpiece and said anode are relatively
moved while a voltage is applied between said workpiece and
said anode.

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6. An electrochemical machining apparatus comprising:

a machining chamber for holding ultrapure water;

an anode immersed in said ultrapure water held in said
machining chamber;

25 a workpiece holding portion for holding a workpiece at a
predetermined distance from said anode so that a surface, to
be machined, of said workpiece is brought into contact with
said ultrapure water;

a cathode contact brought into contact with said workpiece held by said workpiece holding portion so that said workpiece serves as a cathode;

5 a catalyst disposed between said anode and said workpiece held by said workpiece holding portion for dissociating water molecules into hydrogen ions and hydroxide ions; and

a power source for applying a voltage between said anode and said workpiece.

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7. An electrochemical machining apparatus according to claim 6, wherein said catalyst is a nonwoven fabric having an ion exchange function.

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8. An electrochemical machining apparatus according to claim 7, wherein an ion exchange group in said nonwoven fabric having an ion exchange function is selected from the group consisting of anion exchange groups and cation exchange groups.

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9. An electrochemical machining apparatus comprising:

a machining chamber for holding ultrapure water;

a rotatable holding portion for detachably holding a workpiece so as to immerse said workpiece in said ultrapure water held in said machining chamber;

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a machining electrode immersed in said ultrapure water held in said machining chamber, said machining electrode being disposed at a predetermined distance from said workpiece held by said holding portion;

a catalyst disposed between said workpiece held by said holding portion and said machining electrode for dissociating water molecules present between said machining electrode and said workpiece into hydrogen ions and hydroxide ions;

5 a power source for applying a voltage between said machining electrode and said workpiece; and

an ultrapure water supply nozzle for supplying ultrapure water between said machining electrode and said workpiece from the upstream side of a direction of rotation of said machining
10 electrode.

10. An electrochemical machining apparatus according to claim 9, further comprising:

an ultrapure water circulation/purification device for
15 purifying said ultrapure water held in said machining chamber to circulate said ultrapure water; and

a high-pressure ultrapure water supply unit for supplying high-pressure ultrapure water to said ultrapure water supply nozzle.

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11. An electrochemical machining apparatus comprising:

a machining chamber for holding ultrapure water;

a rotatable holding portion for detachably holding a workpiece so as to immerse said workpiece in said ultrapure
25 water held in said machining chamber;

a rotatable machining electrode immersed in said ultrapure water held in said machining chamber, said machining electrode being disposed at a predetermined distance from said

workpiece held by said holding portion;

a catalyst disposed between said workpiece held by said holding portion and said machining electrode for dissociating water molecules present between said machining electrode and
5 said workpiece into hydrogen ions and hydroxide ions; and

a power source for applying a voltage between said machining electrode and said workpiece;

wherein said machining electrode has at least one of a columnar shape and a cylindrical shape, and a shaft center in
10 a direction parallel to a plane of rotation of said workpiece held by said holding portion.

12. An electrochemical machining apparatus according to claim 11, further comprising:

15 an ultrapure water circulation/purification device for purifying said ultrapure water held in said machining chamber to circulate said ultrapure water; and

a high-pressure ultrapure water supply unit for supplying high-pressure ultrapure water to an ultrapure water
20 supply nozzle.

13. An electrochemical machining apparatus comprising:

a machining chamber for holding ultrapure water;

a rotatable holding portion for detachably holding a
25 workpiece so as to immerse said workpiece in said ultrapure water held in said machining chamber;

a rotatable machining electrode immersed in said ultrapure water held in said machining chamber, said machining

electrode being disposed at a predetermined distance from said workpiece held by said holding portion;

a catalyst disposed between said workpiece held by said holding portion and said machining electrode for dissociating water molecules present between said machining electrode and said workpiece into hydrogen ions and hydroxide ions; and

a power source for applying a voltage between said machining electrode and said workpiece;

wherein said machining electrode has at least one of an elliptical shape and a spherical shape, and a shaft center in a direction parallel to a plane of rotation of said workpiece held by said holding portion.

14. An electrochemical machining apparatus according to claim 13, further comprising:

an ultrapure water circulation/purification device for purifying said ultrapure water held in said machining chamber to circulate said ultrapure water; and

a high-pressure ultrapure water supply unit for supplying high-pressure ultrapure water to an ultrapure water supply nozzle.

15. An electrochemical machining method comprising:

disposing a machining electrode and a workpiece in ultrapure water in such a state that a predetermined space is formed between said machining electrode and said workpiece;

disposing a catalyst for dissociating water molecules into hydrogen ions and hydroxide ions, between said machining

electrode and said workpiece;

applying a voltage between said machining electrode and said workpiece; and

supplying ultrapure water between said machining
5 electrode and said workpiece from the upstream side of a direction of rotation of at least one of said machining electrode and said workpiece while at least one of said machining electrode and said workpiece is being rotated.

10 16. An electrochemical machining method comprising:

disposing a machining electrode and a workpiece in ultrapure water in such a state that a predetermined space is formed between said machining electrode and said workpiece;

disposing a catalyst for dissociating water molecules
15 into hydrogen ions and hydroxide ions, between said machining electrode and said workpiece;

applying a voltage between said machining electrode and said workpiece; and

simultaneously rotating said machining electrode and
20 said workpiece while said machining electrode and said workpiece are brought into line contact with each other.

17. An electrochemical machining method comprising:

disposing a machining electrode and a workpiece in
25 ultrapure water in such a state that a predetermined space is formed between said machining electrode and said workpiece;

disposing a catalyst for dissociating water molecules into hydrogen ions and hydroxide ions, between said machining

electrode and said workpiece;

applying a voltage between said machining electrode and said workpiece; and

simultaneously rotating said machining electrode and
5 said workpiece while said machining electrode and said workpiece are brought into point contact with each other.